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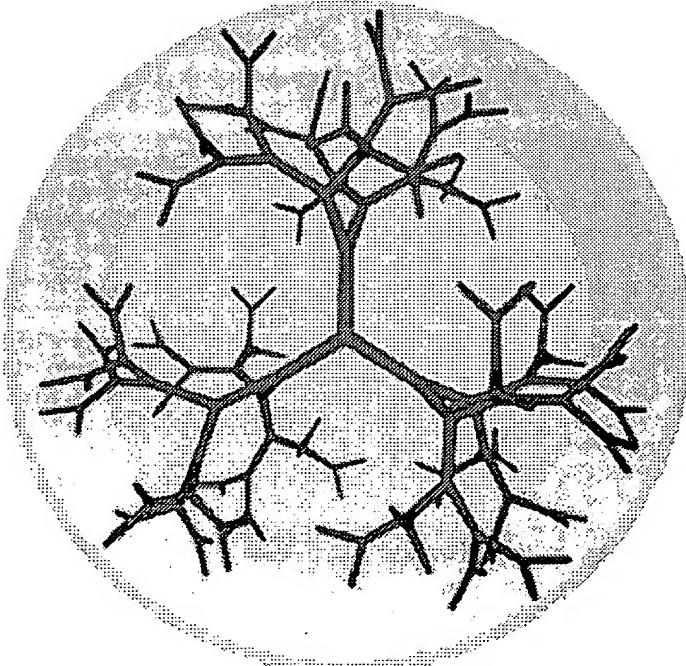
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Dendrimer Chemistry

It is frequently said that shape and function are closely interrelated. As control of structure on the nanometer scale is becoming increasingly important, this aspect of nanoscale chemistry is critical. In analogy with smart biological macromolecules such as enzymes, proteins, etc., which have precisely defined 3-dimensional structures, our scientists have developed a wide range of strategies and concepts for the synthesis, characterization, and applications of synthetic 3-dimensional macromolecules called dendrimers. It is anticipated that the structural control afforded by these approaches will permit the use of dendrimers as the active component, or in the manufacture of advanced microelectronics and magnetic storage devices.

Dendritic macromolecules, or dendrimers, are synthetic 3-dimensional macromolecules that are prepared in a step-wise fashion from simple branched monomer units, the nature and functionality of which can be easily controlled and varied. Their unique architecture and monodisperse structure has been shown to result in numerous previously unknown or significantly improved physical and chemical properties when compared to traditional linear polymers. As a consequence, dendrimers are now considered to be one of the prime nanometer-scale building blocks for the construction of nanoscale objects, molecular devices and molecular 'machines', advanced drug-delivery systems, etc.



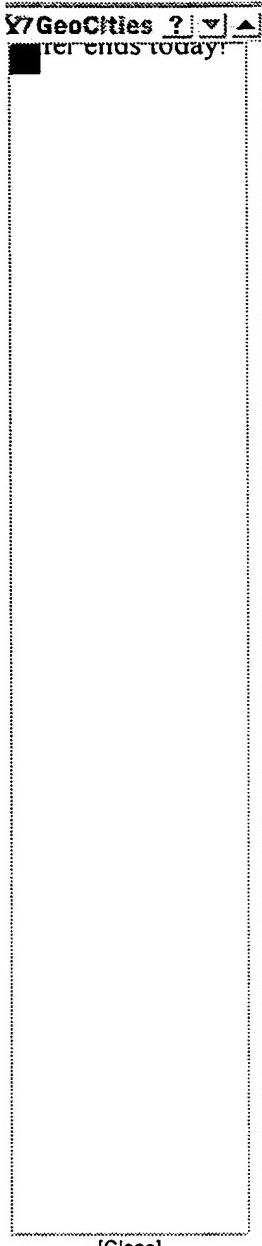
Dendrimer: Here is a dendrimer.

Property	Linear	Dendrimer
Shape	random coil	spherical
Viscosity	high	low
Solubility	low	high
Crystallinity	high	amorphous
Reactivity	low	high
Compatibility	low	high
Compressibility	high	low
Structural control	low	very high

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Dendrimers!!

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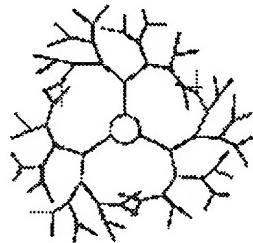
Welcome to my home page!

I have worked to provide a base for presenting the wonderful world of dendrimers - what they are, what types, and their applications.

dendrimers?

A new class of macromolecules or polymers (big molecules, like plastics, proteins, and nucleic acids) have a regular branching structure, like an ideal tree. Other names for these molecules are dandelion, hyperbranched or fractal polymers. Conventional polymers, for example, polyethylene (plastic packaging), polyethyleneterephthalate (PET, plastic drink bottles), and polystyrene (PS, polycarbonate) are basically long chains, ie linear polymers.

The structure of a dendrimer is given below:



This is a dendrimeric polymer.

Conventional polymers have a spaghetti-like structure the difference is conventional polymers as "spaghetti" and dendrimers as "dandelions".

Special about dendrimers?

Dendrimers, when produced by stepwise synthesis (linking branches in stages, from the edge, or leaves down to the core, or root) are monodisperse. This means that these polymers have a precise molecular weight and size. Normal polymer synthesis results in a mixture in which chains are of differing lengths, and so there is a distribution of molecular weights and sizes. So what?, you may ask. Well, when we wish to study the physical properties of polymers, having a mixture of different size polymers makes the situation rather messy, and the theory gets horribly complicated. So it's always a good idea to start with something simple to figure out what the heck is going on.

Another special feature of dendrimers, especially when they are large, is that they tend to form nice spherical shapes with a well-defined interior and exterior. This results in some of their peculiar properties, in particular in having low specific viscosities. They have also been found to act as molecular micelles, in which they become special containers for other molecules. Combined with their large size and geometry (DNA is found to wrap around particular dendrimers), they are being investigated as drug delivery and anti-cancer agents.

Why am I interested in them?

My interest in dendrimers stems (pardon the pun) from the surface activity of particular dendrimer branches. This arises from the hydrophobic (water-fearing) edge parts, and the hydrophilic (water-loving) core, so that these branches tend to stand up on a water surface like a nano-forest, cores (roots) going into the water, and the branches going up into the air. If a small amount of these dendrimers is spread, then they will form an extremely thin molecular film, only one molecule thick (a monolayer).

If the water surface area is reduced, then the molecules will be clumped together, and then the monolayer gets squeezed. Because of this, there will be a mechanical resistance, which is registered as a change in surface tension. If the monolayer is compressed enough, then it must relieve the stress by moving from two dimensions to three. This means that the molecules either go into the water, or go up into the air making thicker films (multilayers).

My the aim of my research is to find out the how the monolayer collapses, and what structures are formed as they are squeezed, as well as how I can relate this to the structure of the dendriemr molecules themselves. This will aid our understanding of surface-active polymers, and to surface science in general. Surfaces are very important, everything tends to happen at the surface!

So how are dendrimer films studied?

As is the rule for science, a range of techniques must be used to obtain a good picture of what's going on. The primary tool of study for molecules on liquid surfaces is the Languir trough. It really is just a small Teflon bath, with a motorised barrier (to change the area), and some means of measuring the surface tension. Usually this is by measuring the "pull" of the surface on a small strip of paper. By plotting the surface pressure (directly related to surface tension) versus the surface area, one obtains a so called pi-A isotherm. These are characteristic of the surface-active molecules, and useful to find out the physical properties and "footprint" of the moelcules.

A second technique is reflectometry (using neutrons or X-rays). A beam of particles from some source (for example an X-ray generator, a nuclear reactor or a spallation target) is directed at a small, glancing angle across the surface to be studied, and the reflected beam is registered at a counter. Due to the differing reflectivities of different beam wavelengths (an analogy is different colours of visible light) from surface structure, a reflectogram (reflectivity spectrum) is obtained. This technique is sensitive to the vertical profile of very thin surface films, in terms of thickness of scattering materials.

Combining the techniques gives a molecular picture or explanation of the processes that are detected in using the Langmuir trough.

● Links to dendrimer researchers:

● [Chris Thomas](#) (link may need updating)

UCSD, U.S.A.

● [Suzuki Zemi](#)

Yamagata University, Japan

● [UECD, Yamagata Uni](#)

Index in English

● [Andrew N Shipway.](#) (Updated link when available)

Birmingham, UK

•Other personal links:

Where I am currently working:-

- [Department of Chemistry, IUPUI](#)

Where I completed my Doctoral thesis:-

- [Research School of Chemistry, ANU](#)

Some friends with homepages:

- [Matt Gray \(Budgie page\)](#)
 - [Jason Harper \(HP at the RSC\)](#)
 - [Jan Thurling \(palace of procrastination\)](#)
-

About me?

I am currently working as a post-doctoral researcher at Indiana University - Purdue University, at Indianapolis (IUPUI). My professor is Prof. Paul L. Dubin, a well-known expert in polyelectrolytes and colloidal systems. My research in dendrimers is now modified to use of Newkome-type dendrimers as model charged colloidal particles with regard to polyelectrolyte adsorption (among many other projects). Stay tuned for further info.

Weather

[Indianapolis, IN](#)

-3...4 C



This info is now old.

Briefly, I am a graduate student in Chemistry, studying at the Research School of Chemistry at the [Australian National University](#). These are the last few months of writing a thesis. I currently live in Canberra, in the [Australian Capital Territory](#). That's right, where the [pollies](#) live! Not only is it the site of the federal government, it is also the site of "Floriade", a festival of flowers which happens annually. Don't miss it!

For more information, see [my other homepage](#).

You are visitor number  since September 1997.

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Resolution of calixarene resist under low energy electron irradiation

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The resolution and sensitivity of calixarene resists in relation to incident electron energy were studied. While the sensitivity of the resists was varied in compliance with Bethe theory for the changes of the electron energy, resolution of the resists in terms of the minimum dot size, shows almost the same value of about 10 nm for each electron energy. A Monte Carlo simulation suggests the electron dose at the edge of the dot pattern was only one hundredth of that at the center of the electron beam. This means the major factor in limiting the resolution in calixarene resists was not the electron beam profile, but other factors such as a limit due to development processes.

1. Resist characteristics

Calixarenes are ring-shape structures 1 nm in diameter (Fig. 1), and have a mono-dispersive molecular weight. The minimum pattern size fabricated using MC6AOAc had 10-nm-diameter dots, and was composed of high-density dot arrays.

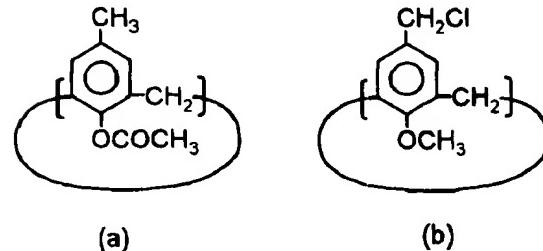


Figure 1. Molecular structure of calixarenes
two types of
(a) 5,11,17,23,29,35-hexamethyl[37,38,39,40,41,42-
hexaacetoxycalix-[6]arene as MC6AOAC,
(b) 5,11,17,23,19,35-Hexachloromethyl[7,38,39,40,41,
42]hexamethoxyxcalix[6]arene as CMC6AOMe.

*2-1-14, Daita, Setagaya, Tokyo 155, Japan

with a 25-nm period.^{1,2,3} This is a superior resolution performance under 50-keV-electron irradiation, though sensitivities were not especially good (about 7 mC/cm² for MC6AOAc and 700 μC/cm² for CMC6AOMe). Hereafter, all experiments were done as follows; both resists were prepared using mono-chlorobenzene as a solvent, 1.5 wt. % of resist solutions were spin-coated for 1 min. at 4000 rpm, coated resists were dried for 30 min. in an N₂ gas flow oven at 170°C, and resist thicknesses of 40 nm were obtained after these processes. The usage of mono-chlorobenzene seems to be effective in avoiding problems when one uses o-dichlorobenzene as solvent; o-dichlorobenzene sometimes causes a milky solution due to insufficient dissolution of calixarene in o-dichlorobenzene.

It is well known that decreasing electron beam energy increases the sensitivity, and in fact, calixarene's sensitivity dose depends on electron beam energy, as shown in Fig. 2. The criteria of the error bars are defined for the dose where 20% and 80% of the dot pillars were standing in the dot array for each electron energy. These experiments were done by using JEOL 5FE for 50keV, and Hitachi S5000 for 5, 10, 15, and 25 keV. Decreasing the electron energy by one tenth increased the sensitivity by 10 times for both calixarene resists. This seems to agree well with the energy absorbency properties estimated by using the Bethe equation as shown in

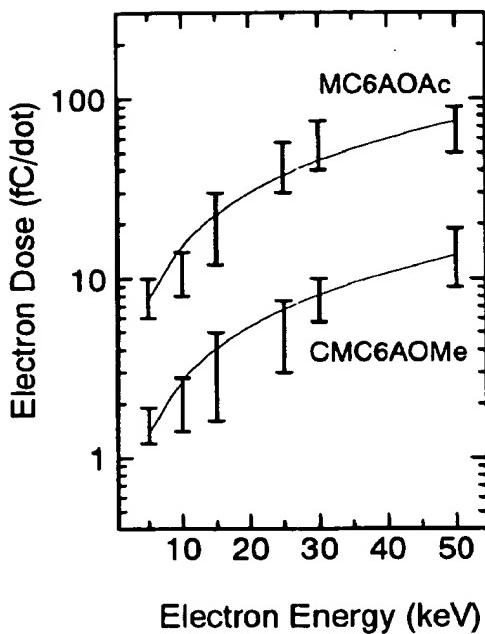


Figure 2. Required spot dose for dot formation vs. electron energy.

the solid lines in Fig. 2:

$$E_{\text{dot}} \propto C/E \cdot \log(\alpha E).$$

Figure 3 shows the dot-diameter dependence on electron dose (spot dose). The electron beam diameters (2δ) were estimated to be below 3 nm at 10 keV, which seems small enough for a 10-nm dot. Of interest is that the resolution (represented by the dot diameter) at a low accelerating voltage of around 10 keV still stays at about 10 nm in the dot array pattern. Both resists exhibited a steep inclination at a low acceleration voltage, showing the sensitivity to be higher than that at 50 keV. However, the minimum dot size did not change. To make a high-density dot array for the purpose of high-density recording media, one should choose the MC6AOAc resist, since the gentle slope of the dot size means the dot diameter is insensitive to the forward-scattered electrons (proximity effect), which are quickly increased with reducing the dot pitch. However if one should want to make a small but pure pattern, one should choose CMC6AOMe (high-sensitivity calixarene). Typically a pattern of single electron transistor (SET) circuit as well as a

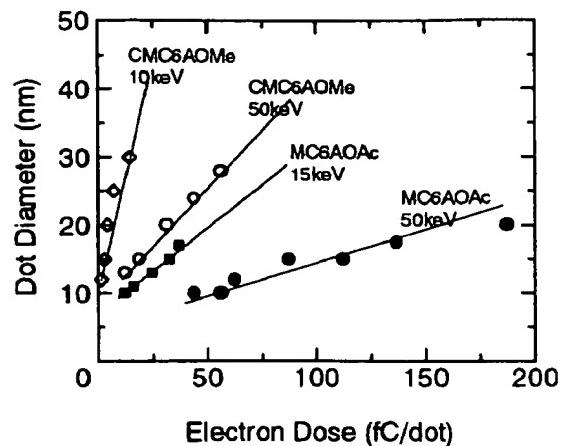


Figure 3. Dot diameter dependence on electron dose.

MOS transistor having an ultra small gate would have pure pattern and they would favor the MC6AOAc.

A typical dot array pattern for MC6AOAc at 15 keV is shown in Fig. 4. The electron dose used to fabricate the array was 24 fC/dot, which was a little bit under the dose shown in Fig. 2. The clear edge of the dot pillars was measured to be about 10 nm in diameter, and there was small dispersion of the dot diameter. These are some of the superior



Figure 4. Typical dot array pattern of MC6AOAc exposed with a 15 keV electron beam.

characteristics of calixarene resist as compared to other polymer resists. Fallen dots, however, reveal that the dot pillar height was about 40 nm, having an aspect ratio of 4.

2. Comparison to Monte Carlo simulation

Next, the resolution of the calixarene resists is discussed. Our experimental results showed that the minimum dot size of the calixarene resists always stayed at about 10 nm in size even when the electron beam energy was changed. The common situation for an exposed resist at each accelerating energy is as follows: the size (dot diameter) of the resist does not change even if the electron dose is reduced. Only the ratio of standing dot to the total number decreases. At a dose smaller than the one where all the dot pillars fell down, which we have defined as the critical electron dose (D_c), there are still some collapsed pillars which have kept their cylindrical shape. However, at a dose of half the D_c , there is nothing left. The Monte Carlo simulation will help us to understand what causes exposure around the critical spot dose.

The simulation we used here is a traditional one which basically takes into account the continuous energy loss (continuous slowing down approximation (CSDA)) by inelastic scattering, which involves excitations from core and outer shell electrons so as to agree empirically with experimental results. We also assumed the primary electron causes a first elastic scattering at the top of the resist surface in accordance with the probability of the screened Rutherford scattering. Therefore the deposited energy density was obtained by accumulating the inelastic loss due to the CSDA for all electrons trajectories, where the mean free path was defined as a function of the electron energy.

To compare the Monte Carlo simulation with experiments, we assumed a critical energy density ϵ_c [eV/nm³]. Then the deposited energy density (DED) as a function of radial distance, $E(r)$, could be combined with electron dose as a function of dot diameter (radii) $D(r)$ by using ϵ_c .

$$E(r) = \epsilon_c / D(r)$$

Figure 5 shows the data for both MC6AOAc (low sensitive) and CMC6AOMe (high sensitive) calixarene resists in the Monte Carlo

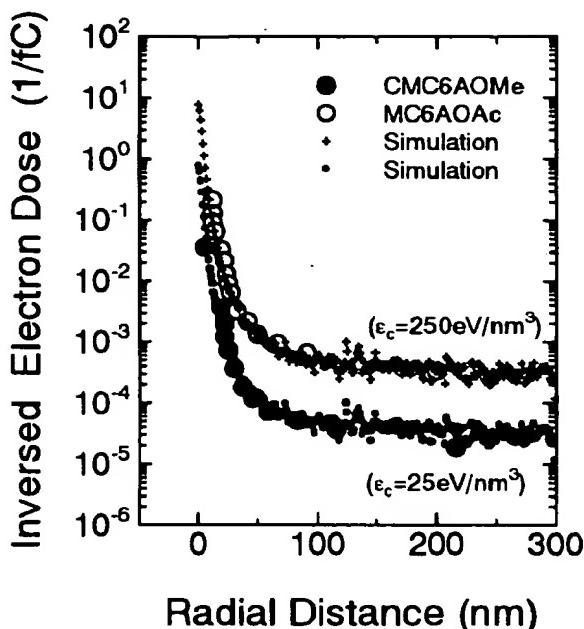


Figure 5. Comparison with Monte Carlo simulation. A Gaussian beam profile with $\delta = 3$ nm, and the accelerating voltage of 10 keV was assumed.

simulation at 10-keV exposure. While a double gaussian approximation frequently fails with fitting at the transient from forward-scattering to back-scattering around 50 nm distance, our Monte Carlo simulation reproduced well this region. In addition, the sensitivity of the CMC6AOMe was about 10 times higher than that of the MC6AOAc, this difference was also reproduced well by the difference of the ϵ_c for each resist, suggesting the reliability of the simulation. The simulation shows that the critical spot-dose level in our experiment was about one hundredth lower than the dose level of the beam center. This means about a one tenth reduction of the electron dose from the critical dose level should still be enough energy to expose, and the dot size could be reduced. We think the resolution limit of a calixarene resist does not depend on the length of the electron lateral scattering, but rather on other factors, such as a limitation of dissolution processes. If we assume the exposure would be enough below the critical spot

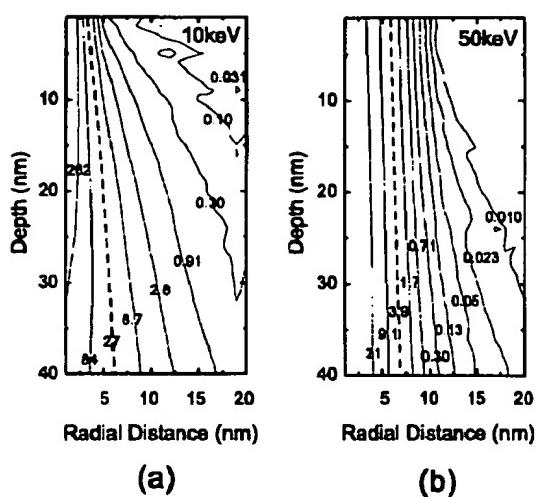


Figure 6. Contour map of deposited energy density for 10-keV and 50-keV electron.

dose and the resist diameter would be shrunk, then the adhesion would also be decreased, maintaining in a delicate balance between such adhesion and dissolution. Further experiments using extremely thin resists will identify the cause of the resolution limit.

Another significant result of low energy exposure was that the minimum dot size was not changed by changing the electron energy. While there was a difference when the electron beam diameter was changed; $\delta=3$ nm for Hitachi S5000 and $\delta=7$ nm for JEOL SFE, the drawn dot was almost the same, about 10 nm. Generally, a less accelerated electron has a large scattering angle in the resist, thus the energy deposition was thought to extend to large area. However, the sensitivity of the resist is increased with the decreasing of the electron energy as shown in Fig. 2. This trade off seems to give the answer. Figure 6 shows contour maps of deposited energy density for 10-keV and 50-keV electron beams, where the resist thickness was assumed to be fixed at 40 nm and MC6AOAc resist was used. In for both contour maps, dashed-line shows the typical exposure dose level (80% of dot will stand) for each accelerating voltage. Here we also assumed a critical deposited energy ϵ_c of 250 eV/nm³. It should be noted that the exposed area

estimated from the map is almost the same for both accelerating voltages. The ϵ_c should be a unique value of each resist; for example, 11 eV/nm³ for PMMA resist combined with a special developer (MIBK:IPA=1:3), which sensitivity is 20 times higher than that of the calixarene resist. We think the resolution is achieved on delicate but canceling out factors between extending the effective DED area and reduction of the effective required dose, thus, the minimum dot size has an insensitive dependence on electron energy. If the beam diameter of the 50-keV-electron could be reduced, smaller dot would be obtained. All these arguments were done on the assumption that the resist thickness was very thin, about 40 nm. However, the resist thickness should be scaled down with pattern size. In addition, increase of the sensitivity contributed to a high-throughput process as well as to low damage of the substrate. Low energy electron beam lithography seems to be useful for nanofabrication.

3. Conclusion

The resolution and sensitivity of calixarene resists in relation to the incident electron energy were studied. While the sensitivity of the resists was varied in compliance with the Bethe theory, the resolution of the resists shows almost the same value of about 10 nm even when the electron energy was changed. The Monte Carlo simulation suggests the energy density needed to form the minimum dot was only one hundredth of that of the beam center. This means the major factor in limiting the resolution in calixarene resists was not the electron beam profile, but rather other factors such as a limitation of the development processes.

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2. Y. Ohnishi, J. Fujita, Y. Ochiai, and S. Matsui, *Microelectronic Engineering*, 35(1997)117.
3. J. Fujita, Y. Ohnishi, Y. Ochiai, E. Nomura, and S. Matsui, *J. Vac. Sci. Technol. B*, Vol 14 (1996) 4247.



ELSEVIER

Systematic studies of functionalized calixarenes as negative tone electron beam resist

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Abstract-We present a systematic study on properties of calix[n]arenes as a high resolution negative tone electron beam resist. From experiments changing the ring sizes of the calix[n]arenes with n=4,6,8 as well as the functionalisation of the arenes we conclude that electron beam irradiation causes the arenes to break up and link to other arenes or functionalizing groups. This is confirmed by exposing resorcin[4]arene. We demonstrate that this material also shows negative tone high resolution resist features, and patterns are transferred into silicon.

1. Introduction

In electron beam lithography there is a need for an ultra high resolution negative tone resist. Recently, it has been shown that calix[6]arenes have the potential of patterning down to the 10 nm regime [1]. However, the high dose of mC/cm² is still too high for a wide spread application. The calixarene molecules are about 1 nm in size and consist of a ring of arenes with two functionalizing groups [2]. Ohnishi et al. [3] showed, that changing the functional groups of the calix[6]arenes can influence the sensitivity of the resist. In addition the material is stable up to 320°C and shows a high etch resistance. The small size of the molecules is essential for the high resolution properties of this resist. But still the mechanism is unknown and a systematic study on this resist has not been published. In order to improve resist adhesion, knowledge about the mechanism is needed. We therefore performed a systematic study on the resist properties of different calix[n]arenes (n=4,6,8), as well as the dependency of the

resist properties on the functionalisation of the calix[n]arenes. Further information can be obtained by testing other arenes as electron beam resists. We therefore also performed experiments on resorcin[4]arene.

2. Synthesis of the arenes

The studied *p-t*-butylcalix[n]arenes (a-c in figure 1) have been prepared according to the cited literature procedures [4]. Dealkylation on the "upper rim" of b could be achieved by retro-Friedel-Crafts-alkylation using anhydrous aluminumtrichloride/phenol in toluene to obtain the calix[6]arene d. Finally the derivative e has been synthesised from b by complete methylation of the "lower rim" with methyl iodide/sodium hydride in DMF/THF. Special attention was paid to the purification of the calix[n]arenes, because of its strong influence on the solubility.

The resorcin[4]arenes have been synthesized as described in the literature [5]. In the first step, the resorcin[4]arene cyclotetramer was formed by condensation of resorcinol with

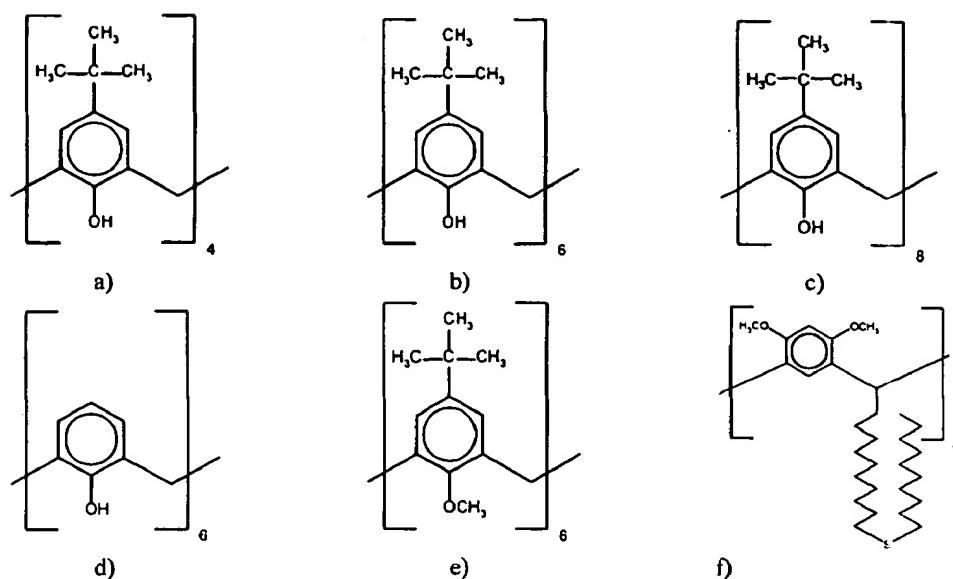


Figure 1: Structures of the used *p*-*t*-butylcalix[4,6,8]arenes as well as the resorcin[4]arene

undecylenic aldehyde in a mixture of ethanol and hydrochloric acid (55% yield). The hydroxy groups of the resorcin[4]arene were modified by alkylation with iodomethane in DMF (60% yield). Finally, a thiol (1-decanethiol) was successfully added to the double bonds of the alkyl chains (80% yield). After cleaning and drying, the overall yield was 26%. The structure of the product was proofed by NMR, IR and elementary analysis.

3. Experimental

The calix[n]arenes were dissolved in dichloromethane and films with thicknesses varying from 40 to 200 nm were spun on Si wafers and prebaked at 160°C for 1 minute. To estimate the sensitivity we used a 25 keV electron beam lithography system and

development in isopropylalcohol. To test the high resolution features of the resist, a Philips XL30 FEG scanning electron microscope was used. A newly developed digital pattern generator [6] was connected to the microscope to produce the deflection signals.

Pattern transfer was carried out in an Oxford Plasmalab 80 RIE tool with a mixture of 45 sccm CHF₃ and 6 sccm O₂ at a pressure of 75 mTorr and a power density of 0.5 W/cm².

4. Sensitivity

In order to study the mechanism of the resist we exposed films of *p*-*t*-butylcalix[4,6,8]arenes to 25 keV electrons and estimated the sensitivity dependence on the number of arenes, as shown in figure 1a-c. Figure 2 shows that the sensitivity of the

calix[6]arene used in this study is similar to that reported from *p*-methylcalix[6]arene. This is a first indication that this modification in the functionalizing groups is not significant, and that the obtained results also apply to *p*-methylcalix[6]arene.

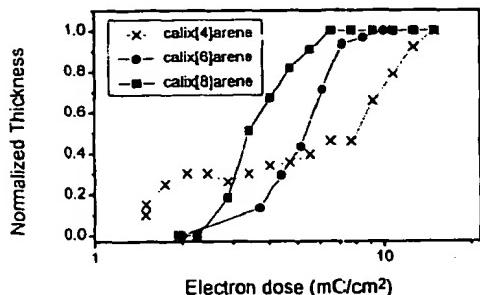


Figure 2: Development curves for different calix[n]arenes ring sizes ($n=4,6,8$).

With decreasing number of arenes, the resist seems to become less sensitive. This can be explained by the decreasing size of the molecules.

In a second experiment we changed systematically each of the functionalizing groups leaving the other groups constant. Changing the "lower rim" (fig. 1e) did not change the sensitivity significantly, whereas the change of the "upper rim" (fig. 1d) reduced the sensitivity, as shown in figure 3. Generally, the exposed regions of the resist could not be dissolved in dichloromethane. This indicates, that the residual material does not contain calix[n]arenes anymore.

From these experiments we conclude, that the resist properties are not due to the calix-shape of the arenes, but that the arenes break up and link to other arenes or functionalizing groups, like *t*-butyl. With this knowledge, other similar molecules should also show this behaviour.

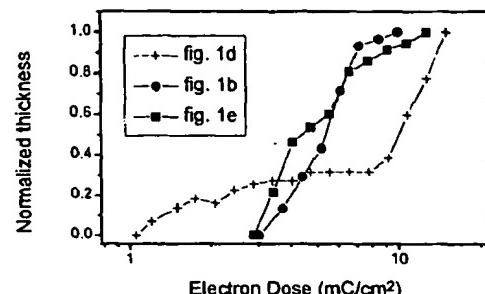


Figure 3: Development curve of calix[6]arenes with different functionalizing groups as depicted in figure 1.

As one of the problems with calix[n]arenes is the poor solubility [2] we synthesized the resorcin[4]arenes with an added thiol. This molecule has good solubility (we used MIBK as solvent and developer), good adhesion to the substrate and a size of 1 nm, measured by scanning tunneling microscopy. In addition this molecule is clearly more sensitive than the calix[6]arenes (figure 4). This might be due to the large amount of carbon atoms in the thiol. We therefore think, that this material may be an alternative to calix[6]arenes.

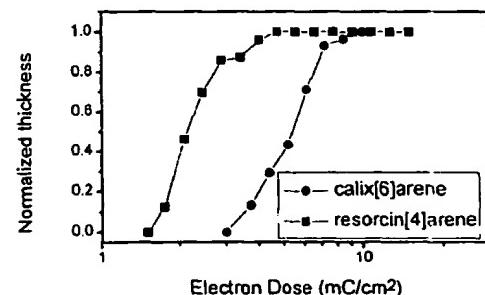


Figure 4. Development curve of resorcin[4]arene compared to *p*-*t*-butylcalix[6]arene.

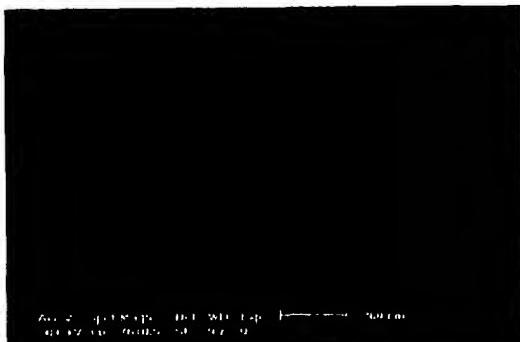


Figure 5. SEM micrograph of a typical resist pattern. These dots were exposed using a dose of 1.1 fC at a beam energy of 25 keV.

5. Structures using resorcin[4]arene

As the main interest for this negative resist is its potential for high resolution e-beam lithography, we exposed a dot pattern in a 40 nm thick resorcin[4]arene film on a Si wafer, using a beam energy of 25 keV and a beam current of 43 pA. After exposure the sample was developed in MIBK for 15 s. A typical resist pattern is shown in figure 5. This demonstrates, that resorcin[4]arenes can be used as a negative high resolution e-beam resist.

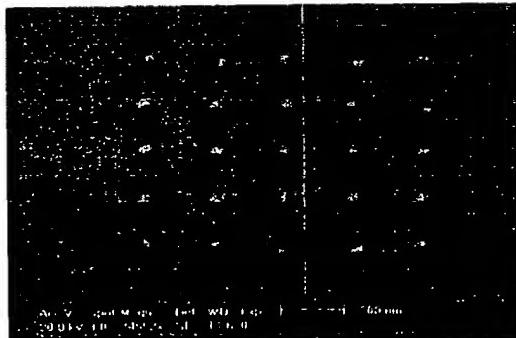


Figure 6. SEM micrograph of Si dots after CH_F_3/O_2 RIE with resorcin[4]arene as an etching mask.

In a next step patterns were transferred into the silicon substrate by reactive ion etching (RIE). With the etching parameters stated above, we estimated a selectivity of the resorcin[4]arene to the silicon of 1.5:1. This is comparable to results obtained earlier on calix[6]arenes [1]. The exposed dot pattern was also transferred into the silicon by RIE, as shown in figure 6.

6. Summary

We have studied the negative tone electron beam resist properties of calix[n]arenes and concluded that the main mechanism of this resist is the breaking up of the arenes, linking to other arenes or functionalizing groups. We demonstrated that resorcin[4]arenes also show this behaviour but at higher sensitivity and transferred dot patterns into silicon by RIE using resorcin[4]arene as an etch mask. Further investigations could focus on other arenes in an attempt to develop a more sensitive high resolution negative tone resist.

References

1. J. Fujita, Y. Ohnishi, Y. Ochiai, S. Matsui, *Appl.- Phys. Lett.*, **68**, 1297 (1996)
2. C.D. Gutsche, *Calixarenes*, Royal Soc. Chem., Cambridge, 1989
3. Y. Ohnishi, J. Fujita, Y. Ochiai, S. Matsui, *Microelec. Eng.* **35**, 117 (1997)
4. C.D. Gutsche, B. Dwawam, K. H. No, R. Mudhukrishnan, *J. Am. Chem. Soc.* **102**, 3782 (1981)
5. Eggo U. Thoden van Velzen, Johan F.J. Engbersen, David N. Reinhoudt, *Synthesis*, 989 (1995).
6. S. Strähle, K.-D. Schock, F.E. Prins, D.P. Kern, *Microelec. Eng.* **35**, 465 (1997)

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(FILE 'HOME' ENTERED AT 16:35:56 ON 15 JAN 2002)

FILE 'CA' ENTERED AT 16:36:01 ON 15 JAN 2002

L1 382 S DENDRIMER? AND PHOTO?

L2 4 S L1 AND (E BEAM OR ELECTRON BEAM)

FILE 'USPATFULL' ENTERED AT 16:37:09 ON 15 JAN 2002

L3 46 S L2

L12 ANSWER 2 OF 3 CAPLUS COPYRIGHT 2002 ACS

AN 1994:469532 CAPLUS

DN 121:69532

TI Positive-working radiation-sensitive resist composition

IN Kajita, Tooru; Oota, Toshuki; Miura, Takao

PA Japan Synthetic Rubber Co Ltd, Japan

SO Jpn. Kokai Tokkyo Koho, 21 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM G03F007-039

ICS G03F007-004; G03F007-028; H01L021-027

CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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PI	JP 05173333	A2	19930713	JP 1991-354297
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AB The title compn. comprises (1) an alkali-sol. resin, (2) a compd. which will generate an acid on irradn. with a radiation, (3) an inclusion compd., and optionally (4) an agent capable of controlling solv. of (1) in an alkali soln. or an agent capable of crosslinking the alkali-sol. resin in the presence of an acid. This compn. shows high resolving power, good heat resistance, etc.

ST resist compn inclusion compd

IT Semiconductor devices
(fabrication of, radiation-sensitive resist compn. for)

IT Resists
(radiation-sensitive, compn. for, contg. inclusion compd.)

IT 1180-60-5 7585-39-9, .beta.-Cyclodextrin 10016-20-3,
.alpha.-Cyclodextrin 17465-86-0, .gamma.-Cyclodextrin 65338-98-9
78092-53-2

RL: TEM (Technical or engineered material use); USES (Uses)
(photoresist compn. contg.)

IT 95418-60-3P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation)
(prepn. and hydrolysis of, for photoresist compn.)

IT 24979-70-2P, p-Hydroxystyrene homopolymer

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation)
(prepn. and reaction of, for photoresist compn.)

IT 24979-70-2DP, p-Hydroxystyrene homopolymer, trimethylsilylated or
tetrahydroxypyranylated 25053-88-7DP, p-Cresol-formaldehyde copolymer,
tetrahydroxypyranylated 25053-88-7P, p-Cresol-formaldehyde copolymer
25085-75-0P, Bisphenol A-formaldehyde copolymer 147625-42-1P

RL: SPN (Synthetic preparation); PREP (Preparation)
(prepn. and use of, for photoresist compn.)

L1 ANSWER 3 OF 3 CA COPYRIGHT 2002 ACS
AN 127:270392 CA
FZ A negative-working alkaline developable photoresist based on **calix**
[4]**resocinarenes**, a crosslinker, and a photoacid generator
AU Ueda, Mitsuru; Takahashi, Daisuke; Nakayama, Tomonari; Haba, Osamu
CS Department of Human Sensing anf Functional Sensor Engineering, Graduate
School of Engineering, Yamagata University, Yonezawa, 992, Japan
SO Polym. Mater. Sci. Eng. (1997), 77, 455-456
CODEN: PMSEDG; ISSN: 0743-0515
PB American Chemical Society
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other
Reprographic Processes)
Section cross-reference(s): 76
AB The classical diazonaphthoquinone/novolak resist is still the workhorse of
the microelectronics industry. We are interested in **calixarenes**
for resist materials as the substitute of novolak resin because of
monodisperse materials and have developed a neg. working photoresist based
on **calix**[4]resorcinarene, 4,4'-methylenebis[2,6-
bis(hydroxymethyl)]phenol (MBHP) as cross-linker, and photoacid generator
diphenyliodonium 9,10-dimethoxyanthracene-2-sulfonate (DIAS). A clear
neg. pattern was obtained when it was exposed to 365 nm UV light and post
baked at 130.degree.C, followed by developing with a 0.5% aq.
tetramethylammonium hydroxide (TMAH) soln. at room temp. Furthermore, to
control the solv. to a TMAH developer, **calix**
[4]methylresorcinarene as the matrix resin for the 2.38% TMAH aq. soln.
has also been developed.
ST neg alk developable photoresist **calixresocinarene** photolithog
IT Photolithography
Photoresists
(neg.-working alk. developable photoresist based on **calix**[4]
resocinarenes, crosslinker, and photoacid generator)
IT Metacyclophanes
RL: TEM (Technical or engineered material use); USES (Uses)
(neg.-working alk. developable photoresist based on **calix**[4]
resocinarenes, crosslinker, and photoacid generator)
IT 13653-12-8, 4,4'-Methylenebis[2,6-bis(hydroxymethyl)]phenol
RL: TEM (Technical or engineered material use); USES (Uses)
(crosslinker; neg.-working alk. developable photoresist based on
calix[4]**resocinarenes**, crosslinker, and photoacid
generator)
IT 75-59-2, Tetramethylammonium hydroxide
RL: TEM (Technical or engineered material use); USES (Uses)
(developer; neg.-working alk. developable photoresist based on
calix[4]**resocinarenes**, crosslinker, and photoacid
generator)
IT 65338-98-9 138233-39-3
RL: TEM (Technical or engineered material use); USES (Uses)
(neg.-working alk. developable photoresist based on **calix**[4]
resocinarenes, crosslinker, and photoacid generator)
IT 137308-86-2, Diphenyliodonium 9,10-dimethoxyanthracene-2-sulfonate
RL: TEM (Technical or engineered material use); USES (Uses)
(photoacid generator; neg.-working alk. developable photoresist based
on **calix**[4]**resocinarenes**, crosslinker, and
photoacid generator)

AN 131:221141 CA

TI Three-component negative-type photoresist based on C-tetraoctyl-
calix[4]resocinarene, a cross-linker, and a photo-acid
generatorAU Nakayama, Tomonari; Takahashi, Daisuke; Takeshi, Kazumasa; Ueda, Mitsuru
CS Departemnt of Human Sensing and Functional Sensor Engineering, Graduate
School of Engineering, Yamagata University, Yamagata, 992-8510, Japan

SO J. Photopolym. Sci. Technol. (1999), 12(2), 347-352

CODEN: JSTEEW; ISSN: 0914-9244

PB Technical Association of Photopolymers, Japan

DT Journal

LA English

CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other
Reprographic Processes)AB Calix[4]resocinarenes(C4-RAs), "C-tetraheptyl-
calix[4]resocinarene [C(7)C4-RA], C-tetraoctyl-calix
[4]resocinarene [C(8)C4-RA], C-tetranonyl-calix[4]resocinarene
[C(9)C4-RA], and C-tetraundecyl-calix[4]resocinarene
[C(11)C4-RA]", were synthesized by the acid-catalyzed condensation of
resorcinol and alkylaldehyde. The obtained C4-RAs were well-dissolved in
common org. solvents and their films were transparent above 300 nm.
Therefore, neg. working photoresists based on C4-RAs, 4,4'-
methylenebis[2,6-bis(hydroxymethyl)]phenol (MBHP) as a cross-linker, and a
photo-acid generator diphenyliodonium 9,10-dimethoxyanthracene-2-sulfonate
(DIAS) has been developed. Particularly, the resist contg. C(8)C4-RA had
the dissoln. property well-controlled by a conventional aq. base developer
[2.38 wt% aq. tetramethylammonium hydroxide(TMAH) soln.]. Thus, the
photoresist consisting of C(8)C4-RA (70 wt%), MBHP (20 wt%), and DIAS (10
wt%) showed a sensitivity of 7 mJ cm⁻² and a contrast of 6.1 when it was
exposed to 365 nm light and postbaked at 130.degree.C for 3 min, followed
by developing with the TMAH developer at room temp.

ST resocinarene photoresist crosslinker photoacid generator

IT Absorption spectra

Crosslinking agents

Dissolution rate

Lithography

Optical properties

Photoresists

Solubility

(3-component neg.-type photoresist based on C-tetraoctyl-calix
[4]resocinarene, cross-linker, and photo-acid generator)IT 116780-43-9P 145375-89-9P 212704-26-2P 221013-61-2P
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)(3-component neg.-type photoresist based on C-tetraoctyl-calix
[4]resocinarene, cross-linker, and photo-acid generator)IT 112-31-2, Decanal 112-54-9, Dodecanal 120-80-9, 2-Hydroxyphenol,
reactions 124-13-0, Octanal 124-19-6, Nonanal

RL: RCT (Reactant)

(3-component neg.-type photoresist based on C-tetraoctyl-calix
[4]resocinarene, cross-linker, and photo-acid generator)

IT 75-59-2, Tetramethylammonium hydroxide

RL: TEM (Technical or engineered material use); USES (Uses)

(3-component neg.-type photoresist based on C-tetraoctyl-calix
[4]resocinarene, cross-linker, and photo-acid generator)

IT 13653-12-8, 4,4'-Methylenebis[2,6-bis(hydroxymethyl)]phenol

RL: PRP (Properties)

(crosslinker; 3-component neg.-type photoresist based on C-tetraoctyl-
calix[4]resocinarene, cross-linker, and photo-acid
generator)

IT 137308-86-2, Diphenyliodonium 9,10-dimethoxyanthracene-2-sulfonate

RL: PRP (Properties)

(photoacid generator; 3-component neg.-type photoresist based on
C-tetraoctyl-calix[4]resocinarene, cross-linker,
and photo-acid generator)

RE.CNT 13 THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

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- (2) Bohmer, V; Angew Chem Int Ed 1995, V34, P713
- (3) Hogberg, A; J Am Chem Soc 1980, V102, P6046
- (4) Hogberg, A; J Org Chem 1980, V45, P4498
- (5) Lee, S; Macromolecules 1994, V27, P5154 CA
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- (7) Nakayama, T; Bull Chem Soc 1998, V71, P2979 CA
- (8) Omote, T; Polym Eng Sci 1992, V32, P1634 CA
- (9) Shaw, J; IBM J Res Develop 1997, V41, P81 CA
- (10) Takeda, N; JP 58-116433 1983 CA
- (11) Tunstad, L; J Org Chem 1989, V54, P1305 CA
- (12) Ueda, M; Chemistry of Materials 1998, V10, P2230 CA
- (13) Willson, C; Introduction to Microlit

L12 ANSWER 3 OF 3 CAPLUS COPYRIGHT 2002 ACS

AN 1993:49297 CAPLUS

DN 118:49297

TI Negtive-working photosensitive composition and patterning
method therewith

IN Onishi, Yoshitake; Mita, Naoko

PA NEC Corp., Japan

SO Jpn. Kokai Tokkyo Koho, 2 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM G03F007-038

v

ICS G03F007-004; G03F007-008; H01L021-027

CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other
Reprographic Processes)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 04155342	A2	19920528	JP 1990-280419	19901018
	JP 2893923	B2	19990524		

AB The title compn. is prep'd. by dissolving a calixarene and(or) its deriv.,
and a crosslinking agent in a solvent. The title method
comprises (1) coating a substrate with the above compn., and removing the
solvent to form a film; (2) selectively exposing the film to light or a
high energy beam; and (3) removing the unexposed regions with a solvent.

ST neg working photoresist calixarene lithog

IT Semiconductor devices

(fabrication of, photoresist for, calixarenes using)

IT Lithography

(patterning method for,)

IT Cyclophanes

RL: USES (Uses)

(meta-, neg.-working photoresist from)

IT Resists

(photo-, neg.-working, calixarenes using)

IT 20237-98-3D, derivs.

RL: MOA (Modifier or additive use); USES (Uses)

(crosslinking agent, neg.-working photoresist from)

IT 78092-53-2D, acetylated 79942-31-7D, acetylated

96627-08-6D, acetylated

RL: USES (Uses)

(neg.-working photoresist from)

LF ANSWER 1 OF 3 CA COPYRIGHT 2002 ACS

AN I31:293201 CA

TI Three-component negative-type photoresist based on C-tetraoctyl-calix[4]resocinarene, a cross-linker, and a photo-acid generator

AU Takeshi, Kazumasa; Takahashi, Daisuke; Nakayama, Tomonari; Ueda, Mitsuru

CS Department of Human Sensing and Functional Sensor Engineering Graduate School of Engineering, Yamagata University, Yamagata, 992-8510, Japan

SO Polym. Mater. Sci. Eng. (1999), 81, 85-86

CODEN: PMSEDG; ISSN: 0743-0515

PB American Chemical Society

DT Journal

LA English

CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)

Section cross-reference(s): 36, 38, 76

AB We have synthesized four types of calix[4]resocinarenes [C4-RA], "C-tetraheptyl-calix[4]resocinarene [C(7)C4-RA], C-tetraoctyl-calix[4]resocinarene [C(8)C4-RA], C-tetranonyl-calix[4]resocinarene [C(9)C4-RA], and C-tetraundecyl-calix[4]resocinarene [C(11)C4-RA], and evaluated the lithog. performance of the three-component neg. working photoresist consisting of C4-RA, 4,4'-methylenebis[2,6-bis(hydroxymethyl)]phenol (MBHP), and diphenyliodonium 9,10-dimethoxyanthracene-2-sulfonate (DIAS). C(8)C4-RA exhibited a good dissoln. behavior in 2.38 % aq. tetramethylammonium hydroxide soln., the conventional base developer for photoresist. Therefore, a new neg. working photoresist was formulated by mixing C(8)C4-RA (70 %), MBHP (25 %) as the cross-linker, and the photoacid generator DIAS (10 %), and showed a high sensitivity and a high contrast to i-line by the development with 2.38 % TMAH developer. It was proved that the dissoln. behaviors of calix[4]resocinarenes could be controlled by the modification of the structure.

ST neg working photoresist tetraoctyl calix resocinarene

IT Negative photoresists

Photolithography

Semiconductor device fabrication

(three-component neg.-type photoresist based on C-tetraoctyl-calix[4]resocinarene, a cross-linker, and a photo-acid generator)

IT 13653-12-8, 4,4'-Methylenebis[2,6-bis(hydroxymethyl)]phenol

RL: TEM (Technical or engineered material use); USES (Uses) (cross-linker; three-component neg.-type photoresist based on C-tetraoctyl-calix[4]resocinarene, a cross-linker, and a photo-acid generator)

IT 75-59-2, Tetramethylammonium hydroxide

RL: TEM (Technical or engineered material use); USES (Uses) (developer; development of three-component neg.-type photoresist based on C-tetraoctyl-calix[4]resocinarene, a cross-linker, and a photo-acid generator)

IT 137308-86-2

RL: TEM (Technical or engineered material use); USES (Uses) (photoacid generator; three-component neg.-type photoresist based on C-tetraoctyl-calix[4]resocinarene, a cross-linker, and a photo-acid generator)

IT 112247-07-1P 120578-24-7P 129779-33-5P 134724-39-3P

RL: PEP (Physical, engineering or chemical process); PRP (Properties); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); PROC (Process); USES (Uses) (prepn. of C-tetraalkyl-calix[4]resocinarenes for three-component neg.-type photoresist)

IT 108-46-3, Resorcinol, reactions 112-31-2, Decanal 112-54-9, Dodecanal 124-13-0, Octanal 124-19-6, Nonanal

RL: RCT (Reactant) (prepn. of C-tetraalkyl-calix[4]resocinarenes for three-component neg.-type photoresist)

RE.CNT 13 THERE ARE 13 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

- (1) Aillen, R; Proc SPIE 1995, V2438, P250 CA
- (2) Bohmer, V; Angew Chem Int Ed Engl 1995, V34, P713
- (3) Hogberg, A; J Am Chem Soc 1980, V102, P6046
- (4) Hogberg, A; J Org Chem 1980, V45, P4498
- (5) Lee, S; Macromolecules 1994, V27, P5154 CA
- (6) Lee, S; Macromolecules 1994, V27, P5160 CA
- (7) Nakayama, T; Bull Chem Soc Jpn 1998, V71, P2979 CA
- (8) Omote, T; Polym Eng Sci 1992, V32, P1634 CA
- (9) Shaw, J; IBM J Res Develop 1997, V41, P81 CA
- (10) Takeda, N; JP 58116433 Jpn Kokai Tokkyo Koho 1983 CA
- (11) Tunstad, L; J Org Chem 1989, V54, P1305 CA
- (12) Ueda, M; Chemistry of Materials 1998, V10, P2230 CA
- (13) Willson, C; Introduction to Microlithography 2nd ed 1994, P139

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| NEWS 26 | Dec 17 | WELDASEARCH now available on STN |
| NEWS 27 | Dec 17 | STANDARDS now available on STN |
| NEWS 28 | Dec 17 | New fields for DPCI |
| NEWS 29 | Dec 19 | CAS Roles modified |
| NEWS 30 | Dec 19 | 1907-1946 data and page images added to CA and CAplus |
| NEWS 31 | Dec 19 | |

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=> s dendrimer? and photo?
3477 DENDRIMER?
1070866 PHOTO?
L1 382 DENDRIMER? AND PHOTO?

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=> s 11 and (e beam or electron beam)
1545617 E
348126 BEAM
5513 E BEAM
          (E(W) BEAM)
1059415 ELECTRON
348126 BEAM
107317 ELECTRON BEAM
          (ELECTRON(W) BEAM)
L2          4 L1 AND (E BEAM OR ELECTRON BEAM)
```

=> d all 1-4

L2 ANSWER 1 OF 4 CA COPYRIGHT 2002 ACS

AN 134:214835, CA
TI Dendrimer-based chemically amplified resists for sub-100-nm
. lithography
AU Tully, David C.; Trimble, Alexander R.; Frechet, Jean M. J.
CS Dep. Chem., Univ. of California, Berkeley, CA, USA
SO Proc. SPIE-Int. Soc. Opt. Eng. (2000), 3999(Pt. 2, Advances in Resist
Technology and Processing XVII), 1202-1206
CODEN: PSISDG; ISSN: 0277-786X
PB SPIE-The International Society for Optical Engineering
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other
Reprographic Processes)
AB Several new poly(benzyl ether) and poly(benzyl ester) **dendrimers**
that incorporate acid- and thermally-labile peripheral groups have been
synthesized. tert-Bu ester terminated poly(benzyl ether)
dendrimers were synthesized using .alpha.-bromo-tert-Bu acetate in
the preliminary protection step to afford the first generation alc. A
std. bromination of the focal point benzylic alc. was used for the
activation step, while std. Williamson ether conditions were used for the
coupling steps to afford higher generation poly(benzyl ether) dendrons.
tert-Bu ester terminated dendrons were then coupled to a difunctional core
to produce the [G-3] **dendrimer**. tert-Bu carbonate (t-Boc)
terminated poly(benzyl ester) **dendrimers** were also synthesized.
This class of **dendrimers** was synthesized by first protecting
monomeric building block 3,5-dihydroxybenzaldehyde with di-t-Bu
dicarbonate. A reductive activation step afforded the [G-1] alc. The
growth steps were accomplished by either Mitsunobu etherification with
3,5-dihydroxybenzaldehyde or by esterification with 5-
hydroxymethylisophthalic acid. Finally, coupling of the benzyl alc.
dendrons to a polyfunctional core afforded second and third generation
dendrimers. Chem. amplified resists formulated from both t-Bu
ester and t-Boc terminated **dendrimers** show high sensitivity to
DUV and e-beam irradn. Feature sizes well below 100
nm have been routinely patterned using e-beam lithog.
ST **dendrimer** based chem amplified **photoresist** vacuum UV
lithog
IT Electron beam resists
 Photoresists
 (chem. amplified; chem. amplified resists for sub-100 nm lithog. based
 on tert-Bu acetate- or tert-Bu carbonate terminated **dendrimers**
)
IT Polyesters, uses
RL: NUU (Other use, unclassified); USES (Uses)
 (**dendrimers**; chem. amplified resists for sub-100 nm lithog.
 based on tert-Bu acetate- or tert-Bu carbonate terminated
 dendrimers)
IT Dendritic polymers
RL: NUU (Other use, unclassified); USES (Uses)
 (polyesters; chem. amplified resists for sub-100 nm lithog. based on
 tert-Bu acetate- or tert-Bu carbonate terminated **dendrimers**)
IT 328396-58-3DP, tert-Bu hydroxyacetate ether-terminated
RL: PNU (Preparation, unclassified); TEM (Technical or engineered material
use); PREP (Preparation); USES (Uses)
 (dendritic; tert-Bu ester terminated **dendrimer** for chem.
 amplified resists for sub-100 nm **photolithog.**)
IT 57840-38-7, Triphenylsulfonium hexafluoroantimonate 213740-80-8
RL: NUU (Other use, unclassified); USES (Uses)
 (photoacid generator; chem. amplified resists for sub-100 nm
 photolithog. based on tert-Bu acetate- or tert-Bu carbonate
 terminated **dendrimers**)
IT 267874-30-6 267874-31-7 305323-42-6 305323-45-9
RL: PEP (Physical, engineering or chemical process); PROC (Process)
 (prepn. of tert-Bu carbonate terminated **dendrimer** for resist
 application)
IT 267874-29-3 328084-37-3 328084-38-4 328084-39-5 328084-40-8
RL: PEP (Physical, engineering or chemical process); PROC (Process)

. (prepns. of tert-Bu ester terminated **dendrimer** for
photoresist application)
IT 200133-25-1
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(prepns. of tert-Bu ester terminated **dendrimer** for resist
application)
IT 26153-38-8, 3,5-Dihydroxybenzaldehyde
RL: RCT (Reactant)
(reaction with di-tert-Bu carbonate in prepns. of ter-Bu carbonate
terminated **dendrimer** for photoresist application)
IT 34619-03-9, Di-tert-butyl carbonate
RL: RCT (Reactant)
(reaction with dihydroxybenzaldehyde in prepns. of ter-Bu carbonate
terminated **dendrimer** for resist application)
IT 5292-43-3
RL: RCT (Reactant)
(reaction with dihydroxybenzyl alc. in prepns. of tert-Bu ester
terminated **dendrimer** for resist application)
IT 29654-55-5, 3,5-Dihydroxybenzyl alcohol
RL: RCT (Reactant)
(reaction with .alpha.-bromo-tert-Bu acetate in prepns. of tert-Bu ester
terminated **dendrimer** for resist application)
IT 267874-32-8P
RL: PNU (Preparation, unclassified); TEM (Technical or engineered material
use); PREP (Preparation); USES (Uses)
(tert-Bu carbonate terminated **dendrimer** for chem. amplified
resists for sub-100 nm photolithog.)
RE.CNT 33
RE

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L2 ANSWER 2 OF 4 CA COPYRIGHT 2002 ACS

AN 134:200432 CA

TI Lithographic performance of advanced thin resists

AU Williamson, Mike; Neureuther, Andrew R.

CS Electronics Res. Lab., Dep. Electr. Eng. Computer Sci., Univ. of California, Berkeley, CA, USA
SO Proc. SPIE-Int. Soc. Opt. Eng. (2000), 3999(Pt. 2, Advances in Resist Technology and Processing XVII), 1189-1197
CODEN: PSISDG; ISSN: 0277-786X
PB SPIE-The International Society for Optical Engineering
DT Journal
LA English
CC 74-5 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)
AB In order to shrink min. feature sizes, many next-generation resists are being developed. One novel resist, based on a hyperbranched, dendritic polymer chem., is examd. and compared to UVII-HS and APEX-E std. resists in order to det. its effectiveness and manufacturability. Data to date shows that many parameters of the dendritic hyperbranched resist are quite comparable to these std. resists: it is sensitive to 35 kV electron-beam at 6 .mu.C/cm², i-line (365 nm) at 600 .mu.C/cm² and 248 nm light. The resist is nearly as resistant to etching as current resist technologies. It can also act as either a pos. or neg. tone resist. Preliminary line edge roughness data show that the **dendrimer** resist appears to be at least comparable if not superior to std. resists in this regard as well. The expected benefits envisioned in the development of dendritic resist materials (by Frechet group, ref 1) appear to be attainable in practice. Namely that higher polymer d. and improved geometry allow smaller end-to-end chain lengths.
ST dendritic polymer **photoresist** lithog performance
IT **Photoresists**
 (chem. amplification; lithog. performance of advanced thin resists based on hyperbranched dendritic polymer)
IT Polyethers, properties
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (dendrimers; lithog. performance of advanced thin resists based on hyperbranched dendritic polymer)
IT Dendritic polymers
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (polyethers; lithog. performance of advanced thin resists based on hyperbranched dendritic polymer)
IT 153700-08-4, APEX-E 181186-90-3, UVII-HS
RL: TEM (Technical or engineered material use); USES (Uses)
 (comparison; lithog. performance of advanced thin resists based on hyperbranched dendritic polymer)
IT 135756-78-4
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (lithog. performance of advanced thin resists based on hyperbranched dendritic polymer)
IT 57840-38-7, Triphenylsulfonium hexafluoroantimonate
RL: PRP (Properties); TEM (Technical or engineered material use); USES (Uses)
 (photoacid generator; lithog. performance of advanced thin resists based on hyperbranched dendritic polymer)
RE.CNT 2
RE
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(2) Uhrich, K; Macromolecules 1992, V25, P4583 CA
L2 ANSWER 3 OF 4 CA COPYRIGHT 2002 ACS
AN 133:357149 CA
TI Dendrimers with thermally labile end groups: An alternative approach to chemically amplified resist materials designed for sub-100 nm lithography
AU Tully, David C.; Trimble, Alexander R.; Frechet, Jean M. J.
CS Department of Chemistry, University of California at Berkeley, Berkeley, CA, 94720-1460, USA
SO Adv. Mater. (Weinheim, Ger.) (2000), 12(15), 1118-1122

CODEN: ADVMEW; ISSN: 0935-9648

PB Wiley-VCH Verlag GmbH

DT Journal

LA English

CC 74-1 (Radiation Chemistry, Photochemistry, and Photographic and Other Reprographic Processes)

AB Chem. amplified resists are described which are based on tert-butoxycarbonyloxy-terminated **dendrimers** and photoacid generators. Resist formulations prep'd. from these **dendrimers** were highly sensitive to both deep-UV and electron-beam exposures, providing reproducible patterning <100 nm.

ST chem amplified lithog resist butoxycarbonyloxy terminated **dendrimer**; photoresist chem amplified butoxycarbonyloxy terminated **dendrimer**; electron beam resist chem amplified butoxycarbonyloxy terminated **dendrimer**

IT Electron beam resists

Photoresists

 (chem. amplified; lithog. chem. amplified resists using tert-butoxycarbonyloxy-terminated **dendrimers**)

IT 305323-50-6P 305820-71-7P

RL: RCT (Reactant); SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (lithog. chem. amplified resists using tert-butoxycarbonyloxy-terminated **dendrimers**)

IT 57840-38-7, Triphenylsulfonium hexafluoroantimonate 240435-11-4

RL: TEM (Technical or engineered material use); USES (Uses)
 (photoacid generator; lithog. chem. amplified resists using tert-butoxycarbonyloxy-terminated **dendrimers**)

IT 26153-38-8P, 3,5-Dihydroxybenzaldehyde 267874-30-6P 267874-31-7P

305323-33-5P 305323-36-8P 305323-39-1P 305323-42-6P 305323-45-9P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation)
 (synthesis of tert-butoxycarbonyloxy-terminated **dendrimers**
 for lithog. chem. amplified resists formulations)

RE.CNT 33

RE

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L2 ANSWER 4 OF 4 CA COPYRIGHT 2002 ACS

AN 130:19749 CA

TI Radiation-sensitive resin and positively or negatively working radiation-sensitive coating composition containing it for patterning of highly integrated circuit board

IN Niimi, Takaaki; Kawa, Manabu

PA Mitsubishi Chemical Industries Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 14 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM G03F007-038

ICS C08L101-00; H01L021-027; C08G063-00; C08G065-00; C08G069-00;
C08G073-02

CC 76-14 (Electric Phenomena)

Section cross-reference(s): 74

FAN.CNT 1

| PATENT NO. | KIND | DATE | APPLICATION NO. | DATE |
|------------|------|------|-----------------|------|
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|----|-------------|----|----------|---------------|
| PI | JP 10282668 | A2 | 19981023 | JP 1997-92124 |
| | | | | 19970410 |

AB The resin with no.-av. mol. wt. measured by gel-permeation chromatog. (GPC) 500-200,000 and Mw/Mw(GPC) >1 [Mw(GPC) = wt.-av. mol. wt. measured by GPC; Mw = true wt.-av. mol. wt. measured by mass spectrometry or optical scattering] comprises a branched polymer terminated with a functional group which gains an affinity or reactivity to liqs. by irradn. of electromagnetic wave, **electron beam**, or their induced chem. reaction or with a crosslinkable group by the same process. The pos.-working radiation-sensitive coating compn. contains 90-99.99 wt.% of the above resin and 0.01-10 wt.% acid generator. The neg.-working radiation-sensitive coating compn. contains 90-99.99 wt.% of the above resin (0.1-50 wt.% of which may replaced with a crosslinking agent) and 0.01-10% **photopolymn.** initiator. Entangling of polymer chains during the curing process is prevented by the controlled structure to improve precision in patterning.

ST radiation sensitive branched resin reactive terminal; neg working radiation sensitive resin patterning; pos working polymer resist entangling prevention; dendritic radiation sensitive resist patterning IC

IT Polyamides, uses

Polyamines (polymeric)

Polyesters, uses

Polyethers, uses

RL: TEM (Technical or engineered material use); USES (Uses)

(**dendrimers**, functional group-terminated; pos.- or

neg.-working radiation-sensitive coating compn. contg.

radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Polyamines (polymeric)

RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(polyamide-, **dendrimers**, functional group-terminated; pos.-

or neg.-working radiation-sensitive coating compn. contg.

radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Dendritic polymers

RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(polyamide-polyamines, functional group-terminated; pos.- or

neg.-working radiation-sensitive coating compn. contg.

radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Dendritic polymers

RL: TEM (Technical or engineered material use); USES (Uses)

(polyamides, functional group-terminated; pos.- or neg.-working

, radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Polyamides, uses
 RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (polyamine-, dendrimers, functional group-terminated; pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Dendritic polymers
 RL: TEM (Technical or engineered material use); USES (Uses)
 (polyamines, functional group-terminated; pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Dendritic polymers
 RL: TEM (Technical or engineered material use); USES (Uses)
 (polyesters, functional group-terminated; pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Dendritic polymers
 RL: TEM (Technical or engineered material use); USES (Uses)
 (polyethers, functional group-terminated; pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Integrated circuits
Negative photoresists
Positive photoresists
 (pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT Resists
 (radiation-sensitive; pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT 66003-78-9, Triphenylsulfonium triflate
 RL: CAT (Catalyst use); USES (Uses)
 (photoacid generator; pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

IT 93376-66-0DP, Starburst 2nd Generation, reaction products with 4-tetrahydropyranloxybenzyl bromide 153891-46-4DP, Starburst 3rd Generation, reaction products with 4-tetrahydropyranloxybenzyl bromide 216011-29-9DP, reaction products with polyamide-polyamine dendritic polymers
 RL: PNU (Preparation, unclassified); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)
 (pos.- or neg.-working radiation-sensitive coating compn. contg. radiation-sensitive branched resin for patterning of highly integrated circuit board)

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| COST IN U.S. DOLLARS | SINCE FILE | TOTAL | |
| | ENTRY | SESSION | |
| FULL ESTIMATED COST | 19.74 | 19.89 | |
| DISCOUNT AMOUNTS (FOR QUALIFYING ACCOUNTS) | SINCE FILE | TOTAL | |
| | ENTRY | SESSION | |
| CA SUBSCRIBER PRICE | -2.36 | -2.36 | |

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 FILE LAST UPDATED: 10 Jan 2002 (20020110/ED)
 HIGHEST GRANTED PATENT NUMBER: US6330719
 HIGHEST APPLICATION PUBLICATION NUMBER: US2002004944

CA INDEXING IS CURRENT THROUGH 10 Jan 2002 (20020110/UPCA)
ISSUE CLASS FIELDS (/INCL) CURRENT THROUGH: 10 Jan 2002 (20020110/PD)
REVISED CLASS FIELDS (/NCL) LAST RELOADED: Oct 2001
USPTO MANUAL OF CLASSIFICATIONS THESAURUS ISSUE DATE: Oct 2001

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>>> terms from the IPC subject headings and subheadings. <<<

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FILE 'CA' ENTERED AT 16:36:01 ON 15 JAN 2002

L1 382 S DENDRIMER? AND PHOTO?

L2 4 S L1 AND (E BEAM OR ELECTRON BEAM)

FILE 'USPATFULL' ENTERED AT 16:37:09 ON 15 JAN 2002

=> s 12

716 DENDRIMER?
422778 PHOTO?
1788369 E
302372 BEAM
4111 E BEAM
(E(W) BEAM)
169421 ELECTRON
302372 BEAM
49709 ELECTRON BEAM
(ELECTRON(W) BEAM)

L3 46 L1 AND (E BEAM OR ELECTRON BEAM)

=> d pn,ab 1-46

L3 ANSWER 1 OF 46 USPATFULL

PI US 6333141 B1 20011225

AB The invention relates to a process for forming an integrated circuit device comprising (i) a substrate; (ii) metallic circuit lines positioned on the substrate and (iii) a dielectric material positioned on the circuit lines. The dielectric material comprises porous organic polysilica.

L3 ANSWER 2 OF 46 USPATFULL

PI US 2001041339 A1 20011115

AB The microarrays of the present invention are prepared by using a separate fiber for each compound being used in the microarray. The fibers are bundled and sectioned to form a thin microarray that is glued to a backing.

L3 ANSWER 3 OF 46 USPATFULL

PI US 6300388 B1 20011009

AB An ink composition for ink jet printing contains an amino functionalized

polyetheracrylate as radiation curable compound.

L3 ANSWER 4 OF 46 USPATFULL
PI US 6296810 B1 20011002
AB The present invention provides a method and apparatus for automated DNA sequencing. The method of the invention includes the steps of: a) using a processive exonuclease to cleave from a single DNA strand the next available single nucleotide on the strand; b) transporting the single nucleotide away from the DNA strand; c) incorporating the single nucleotide in a fluorescence-enhancing matrix; d) irradiating the single nucleotide to cause it to fluoresce; e) detecting the fluorescence; f) identifying the single nucleotide by its fluorescence; and g) repeating steps a) to f) indefinitely (e.g., until the DNA strand is fully cleaved or until a desired length of the DNA is sequenced). The apparatus of the invention includes a cleaving station for the extraction of DNA from cells and the separation of single nucleotides from the DNA; a transport system to separate the single nucleotide from the DNA and incorporate the single nucleotide in a fluorescence-enhancing matrix; and a detection station for the irradiation, detection and identification of the single nucleotides. The nucleotides are advantageously detected by irradiating the nucleotides with a laser to stimulate their natural fluorescence, detecting the fluorescence spectrum and matching the detected spectrum with that previously recorded for the four nucleotides in order to identify the specific nucleotide.

L3 ANSWER 5 OF 46 USPATFULL
PI US 6287765 B1 20010911
AB Multimolecular devices and drug delivery systems prepared from synthetic heteropolymers, heteropolymeric discrete structures, multivalent heteropolymeric hybrid structures, aptameric multimolecular devices, multivalent imprints, tethered specific recognition devices, paired specific recognition devices, nonaptameric multimolecular devices and immobilized multimolecular structures are provided, including molecular adsorbents and multimolecular adherents, adhesives, transducers, switches, sensors and delivery systems. Methods for selecting single synthetic nucleotides, shape-specific probes and specifically attractive surfaces for use in these multimolecular devices are also provided. In addition, paired nucleotide-nonnucleotide mapping libraries for transposition of selected populations of selected nonoligonucleotide molecules into selected populations of replicatable nucleotide sequences are described.

L3 ANSWER 6 OF 46 USPATFULL
PI US 2001012537 A1 20010809
AB A method is disclosed which relates to the placement of binding partners on microarrays, where such binding partners contain proteins, nucleic acids, biological cells and other bio-reactive components. The present invention discloses uses and methods for manufacture of microarrays constructed in part by sectioning bundles of tubules or rods containing matrix immobilized bio-reactive molecules to produce large numbers of sample chips. The chips so produced are processed by deposition to microarrays. The deposited chips can then be manipulated to partition the immobilizing matrix away from the bio-reactive molecules contained in the matrix and to place said partitioned molecules onto various surfaces for subsequent analysis, to include binding assays, hybridization reactions, diagnostic methods and a variety of cell interaction-determining methodologies.

L3 ANSWER 7 OF 46 USPATFULL
PI US 6267864 B1 20010731
AB Methods and devices for transforming less desirable chemical species into more desirable or useful chemical forms are disclosed. The specifications can be used to treat pollutants into more benign compositions and to produce useful chemicals from raw materials and wastes. The methods and devices disclosed utilize continuous or temporary pulse of electrical current induced by electromagnetic field and high surface area formulations. The invention can also be applied to

improve the performance of existing catalysts and to prepare novel devices.

L3 ANSWER 8 OF 46 USPATFULL

PI US 6261687 B1 20010717

AB In one embodiment, the present invention relates to a substrate for an electrical device including a coating, wherein the coating comprises an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor. In another embodiment, the present invention relates to a component for an electrical device comprising an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor. In yet another embodiment, the present invention relates to a microelectronic device comprising an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor.

L3 ANSWER 9 OF 46 USPATFULL

PI US 6261430 B1 20010717

AB A microelectrophoresis chip comprises a substrate in which there are formed one or more channels, one channel for each sample to be evaluated. The channels extend for the length of the chip, a distance of generally around 1 cm, and are about 1 to 10 .mu.m wide and 1 to 10 .mu.m in depth. The channels are filled with a homogeneous separation matrix which acts as an obstacle to the electrophoretic migration of the charged molecules. Microelectrodes disposed in the channels are used to induce an electric field within the homogeneous separation medium. When a voltage is applied across two or more of the microelectrodes, the charged molecules are induced to move and separate according to the electric field density, the type of solvent film, and the charge, shape and size of the charged molecule. The chip may further comprise detectors, such as light polarization detectors, fluorescence emission detectors, biosensors, electrochemical sensors or other microcomponents which may include sites for enzymatic or chemical manipulation of the moved or separated charged molecules.

L3 ANSWER 10 OF 46 USPATFULL

PI US 2001006730 A1 20010705

AB The invention relates to a polymer having at least one group derived from a carboxylic ester of a hydroxyalkylamide and an .alpha.,.beta.-ethylenically unsaturated carboxylic acid and a radiation curable composition comprising this polymer.

A coating composition comprising this composition has a high rate of polymerisation and results in coatings having the desired chemical and mechanical properties.

L3 ANSWER 11 OF 46 USPATFULL

PI US 2001000889 A1 20010510

AB Illustrations are provided on applications and usage of electrically activated catalysts. Methods are disclosed for preparing catalysts from nanomaterials. Processes and devices are described that utilize catalysts. The invention can also be applied to improve the performance of existing catalysts, to enhance the performance of substances by inducing or applying charge in nanostructured forms of substances, and to prepare novel devices. Example processes for hydrogen production are discussed. Finally, the invention can be utilized to engineer the thermal, structural, electrical, magnetic, electrochemical, optical, photonic, and other properties of nanoscale substances.

L3 ANSWER 12 OF 46 USPATFULL

PI US 6224979 B1 20010501

AB In one embodiment, the present invention relates to a substrate for an electrical device including a coating, wherein the coating comprises an oxygen plasma resistant polymer prepared from a mixture containing a

polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor. In another embodiment, the present invention relates to a component for an electrical device comprising an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor. In yet another embodiment, the present invention relates to a microelectronic device comprising an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor.

L3 ANSWER 13 OF 46 USPATFULL

PI US 6214195 B1 20010410

AB Methods and devices for transforming less desirable chemical species into more desirable or useful chemical forms are disclosed. The specifications can be used to treat pollutants into more benign compositions and to produce useful chemicals from raw materials and wastes. The methods and devices disclosed utilize electrical current induced by electromagnetic field and high surface area formulations. The invention can also be applied to improve the performance of existing catalysts and to prepare novel devices.

L3 ANSWER 14 OF 46 USPATFULL

PI US 6187897 B1 20010213

AB A vinyl-group-containing **dendrimer** useful in coating and printing and is curable by any one of conventional triggers such as heating, ultraviolet light, infrared light, electron beams and .gamma. rays, the composition comprising a vinyl-group-containing **dendrimer** (A) comprising a core portion, branching portions, branches and at least 4 terminal portions and having a vinyl group as a terminal portion and a long-chain group and a curable unsaturated-group-containing compound (B), and the composition comprising a vinyl-group-containing **dendrimer** (A) obtained by reacting a polyfunctional compound (a) having at least three active-hydrogen-containing groups in a terminal per molecule and having at least five active hydrogen atoms per molecule with a long-chain-group-containing compound (b) having a functional group reactive with an active hydrogen atom so as to leave part of the active hydrogen atoms, thereby obtaining a long-chain-group-containing multi-branched compound (X), and reacting the long-chain-containing multi-branched compound (X) with a vinyl-group-containing compound (c) having a functional group reactive with an active hydrogen atom and a curable unsaturated-group-containing compound (B).

L3 ANSWER 15 OF 46 USPATFULL

PI US 6183935 B1 20010206

WO 9935536 19990715

AB An inorganic pattern is formed by coating an inorganic substance-containing **photosensitive** composition comprising a **photosensitive** polymer (A), a condensable organic metal compound or a condensate thereof (B) and an inorganic filler having a functional group (C) on a base, exposing the coated layer, and developing the exposed layer to form a pattern, baking the pattern give an inorganic pattern. The **photosensitive** polymer (A) may be constituted of an oligomer or polymer, and a **photosensitizer**, and the condensable organic metal compound (B) may have a **photosensitive** group. The inorganic filler may be a monodispersed colloidal silica having a mean particle size of 2 to 100 nm. The proportions of the components (B) and (C) relative to 1 part by weight of the component (A) on a solid basis are about 1 to 25 parts by weight and about 1 to 20 parts by weight, respectively. Even when the content of an inorganic component is high, an inorganic pattern of high resolution can be formed with the use of the above resin composition.

L3 ANSWER 16 OF 46 USPATFULL

PI US 6176990 B1 20010123

WO 9642013 19961227

AB A microelectrophoresis chip comprises a substrate in which there are formed one or more channels, one channel for each sample to be evaluated. The channels extend for the length of the chip, a distance of generally around 1 cm, and are about 1 to 10 .mu.m wide and 1 to 10 .mu.m in depth. The channels are filled with a homogeneous separation matrix which acts as an obstacle to the electrophoretic migration of the charged molecules. Microelectrodes disposed in the channels are used to induce an electric field within the homogeneous separation medium. When a voltage is applied across two or more of the microelectrodes, the charged molecules are induced to move and separate according to the electric field density, the type of solvent film, and the charge, shape and size of the charged molecule. The chip may further comprise detectors, such as light polarization detectors, fluorescence emission detectors, biosensors, electrochemical sensors or other microcomponents which may include sites for enzymatic or chemical manipulation of the moved or separated charged molecules.

L3 ANSWER 17 OF 46 USPATFULL

PI US 6166439 20001226

AB A semiconductor device which includes a substrate and a conductive pattern formed on the substrate. The conductive pattern includes at least two conductive lines adjacent one another. A low dielectric constant (LDC) material is dispersed between the at least two conductive lines. The LDC material includes a polymeric material including a polymer having a first and second end. The first end includes a functional group adapted to substantially bond to an insulating layer covering at least a portion of the substrate. The second end includes a functional group adapted to substantially bond to a dielectric material deposited over the LDC material. The polymeric material also includes air pockets therein which facilitate mitigation of capacitive crosstalk between the at least two conductive lines.

L3 ANSWER 18 OF 46 USPATFULL

PI US 6159600 20001212

AB In one embodiment, the present invention relates to a substrate for an electrical device including a coating, wherein the coating comprises an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor. In another embodiment, the present invention relates to a component for an electrical device comprising an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor. In yet another embodiment, the present invention relates to a microelectronic device comprising an oxygen plasma resistant polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor.

L3 ANSWER 19 OF 46 USPATFULL

PI US 6133396 20001017

AB Non-pyrophoric polymethylsilane (PMS) SiC precursors allow for preparation of dense phase pure SiC with 1:1 stoichiometry. Sintering aids may be readily and reproducibly incorporated into the hyperbranched PMS. The PMS has rheology suitable for the preparation of films, coatings, fibers, and for processes such as joining and ceramic infiltration densification.

L3 ANSWER 20 OF 46 USPATFULL

PI US 6110339 20000829

WO 9642012 19961227

AB Separation matrices useful in the formation of solid-state mm- to cm-scale devices for the rapid, high-resolution separation of single-stranded DNA ladder bands generated by the Sanger dideoxy- or Maxam/Gilbert chemical DNA sequencing procedures are formed from a solid support (1) having a plurality of posts (4) disposed on a first major surface thereof to form an obstacle course of posts (4) and pores (5). The posts are arranged in a regular X, Y array and are separated one

from another by a distance of 100 nm or less, preferably 10 to 30 nm, and are optionally separated into lanes 2. The separation matrix can be manufactured by first forming a mold, preferably a reusable mold using lithography techniques. The mold is the reverse of the desired pattern of posts and pores of the obstacle course, and is used for casting the obstacle course. The cast obstacle course is then fused to a solid support and separated from the mold. Alternatively, the separation matrix can be formed from a polymer which undergoes specific and quantifiable swelling in the presence of a selected chemical compound. In this case, the matrix is cast on a mold in a conventional manner with a spacing between posts greater than the desired final spacing of 100 nm or less. For use, a buffer solution saturated with the specific chemical agent that controls swelling is added, causing the posts to swell to a defined amount to achieve the desired separation.

L3 ANSWER 21 OF 46 USPATFULL

PI US 6093636 20000725

AB The invention relates to a process for forming an integrated circuit device comprising (i) a substrate; (ii) metallic circuit lines positioned on the substrate and (iii) a dielectric material positioned on the circuit lines. The dielectric material comprises porous organic polyarylene ether.

L3 ANSWER 22 OF 46 USPATFULL

PI US 6030632 20000229

AB An antimicrobial material comprising an antimicrobial metallic material and a biguanide polymer reacted with a crosslinker to form an adduct is described. Both freestanding antimicrobial materials and antimicrobial films are provided. The antimicrobial material does not release biocidal levels of leachables into a contacting solution.

L3 ANSWER 23 OF 46 USPATFULL

PI US 6027890 20000222

AB Methods are provided for detecting the binding of a first member to a second member of a ligand pair, comprising the steps of (a) combining a set of first tagged members with a biological sample which may contain one or more second members, under conditions, and for a time sufficient to permit binding of a first member to a second member, wherein said tag is correlative with a particular first member and detectable by non-fluorescent spectrometry, or potentiometry, (b) separating bound first and second members from unbound members, (c) cleaving the tag from the tagged first member, and (d) detecting the tag by non-fluorescent spectrometry, or potentiometry, and therefrom detecting the binding of the first member to the second member.

L3 ANSWER 24 OF 46 USPATFULL

PI US 6025117 20000215

AB A polysilane having a repeating unit represented by the following general formula (LPS-I), ##STR1## wherein A is a bivalent organic group, R.sup.1 substituents may be the same or different and are selected from hydrogen atom and substituted or unsubstituted hydrocarbon group and silyl group. The polysilane is excellent in solubility in an organic solvent so that it can be formed into a film by way of a coating method, which is excellent in mechanical strength and heat resistance. The polysilane can be employed as an etching mask to be disposed under a resist in a manufacturing method of a semiconductor device. The polysilane exhibits anti-reflective effect during exposure, a large etch rate ratio in relative to a resist, and excellent dry etching resistance.

L3 ANSWER 25 OF 46 USPATFULL

PI US 5997861 19991207

AB Complexes are prepared containing two or more different effector molecules joined to each other by a joining component. One effector molecule is a binding molecule such as an antibody or Fc receptor that binds to a molecular target such as a virus or antibody at a site of infection or tumor, and another effector molecule is a therapeutic

molecule such as an enzyme or drug. The joining component may be a liposome, protein or an organic polymer (including a **dendrimer** type polymer), and may be of sufficient length and/or flexibility to permit the therapeutic molecule to physically interact with the target at the same time as the binding molecule. Supramolecules are formed containing at least two supramolecular component molecules that contain an effector molecule and a nucleic acid chain. A nucleic acid chain on a component molecule is complementary to a nucleic acid chain on another component molecule to enable binding of the component molecules of the supramolecule by the formation of double stranded nucleic acid chains between complementary chains. A targetable antiviral supramolecule is prepared containing spectrin as the joining component. The binding molecule can be an antibody specific for an antigen on a viral particle and the therapeutic molecule can be an enzyme capable of destroying infectivity of the virus by hydrolysis of viral coat protein or viral lipid.

L3 ANSWER 26 OF 46 USPATFULL

PI US 5962608 19991005

AB In one embodiment, the present invention relates to a polymer prepared from a mixture containing a polymerization material and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor. In another embodiment, the present invention relates to a process for making a polymer involving contacting a polymerization material with a metal oxide sol comprising a liquid and a polycondensation product of a partially hydrolyzed chelated metal oxide precursor to form a mixture and at least one of polymerizing and curing the mixture of the polymerization material and the polycondensation product.

L3 ANSWER 27 OF 46 USPATFULL

PI US 5955377 19990921

AB Method for detecting an analyte of interest, comprising the steps of providing a detection device comprising a light reflective or transmissive substrate supporting one or more layers comprising an adhering attachment layer to which is affixed a receptive material which specifically interacts with the analyte of interest; reacting the device with a sample potentially comprising the analyte under conditions in which the analyte binds to the receptive material; and reacting bound analyte with a reagent which creates a mass change on the surface of the device.

L3 ANSWER 28 OF 46 USPATFULL

PI US 5869272 19990209

AB Method for the determination of chlamydial or gram negative bacterial antigen comprising contacting a sample potentially containing extracted antigen with an optically active surface comprising an attachment layer, and a layer of non-specific protein.

L3 ANSWER 29 OF 46 USPATFULL

PI US 5869073 19990209

WO 9517152 19950729

AB A liquid composition for applying a non-leachable antimicrobial coating on a surface. The liquid composition consists of a solution, dispersion or suspension of a biguanide polymer reacted with a cross-linking agent to form an adduct, and an antimicrobial metal material. The resulting antimicrobial coating does not release biocidal levels of leachables into surrounding solution.

L3 ANSWER 30 OF 46 USPATFULL

PI US 5718915 19980217

AB Complexes are prepared containing two or more different effector molecules joined to each other by a joining component. At least one of the effector molecules can bind to a target molecule and at least one of the other effector molecules has therapeutic properties. The joining component can be liposomes, proteins and organic polymers including **dendrimer** polymers, and can be of sufficient length and/or

flexibility to permit the therapeutic effector molecule to interact with a target at the same time as the binding molecules. An antiviral liposome is prepared by coupling to a liposome outer surface a hydrolytic enzyme capable of digesting a viral component and a target-binding moiety which may be a polypeptide, glycoprotein or glycoprotein fragment having specificity for viruses such as HIV-1, influenza virus and hepatitis virus. The hydrolytic enzyme may be a glycosidase, phospholipase, lipase, cholesterol esterase, nuclease or protease. A second hydrolytic enzyme and target-binding moiety may also be present, and albumin may be coupled to the liposome surface. Within the liposome may be an internal hydrolytic enzyme capable of digesting a viral component.

L3 ANSWER 31 OF 46 USPATFULL

PI US 5714166 19980203

AB Dendritic polymer conjugates which are composed of at least one **dendrimer** in association with at least one unit of a carried material, where the carrier material can be a biological response modifier, have been prepared. The conjugate can also have a target director present, and when it is present then the carried material may be a bioactive agent. Preferred dendritic polymers are dense star polymers, which have been complexed with biological response modifiers. These conjugates and complexes have particularly advantageous properties due to their unique characteristics.

L3 ANSWER 32 OF 46 USPATFULL

PI US 5688486 19971118

WO 9315768 19930819

AB Compounds including tight molecular meshes, preferably curved in one or two directions, such as fullerenes and met-cars, can be used as carriers for diagnostic or therapeutic agents, especially diagnostic contrast agents.

L3 ANSWER 33 OF 46 USPATFULL

PI US 5674743 19971007

AB The present invention provides a method and apparatus for automated DNA sequencing. The method of the invention includes the steps of: a) using a processive exonuclease to cleave from a single DNA strand the next available single nucleotide on the strand; b) transporting the single nucleotide away from the DNA strand; c) incorporating the single nucleotide in a fluorescence-enhancing matrix; d) irradiating the single nucleotide to cause it to fluoresce; e) detecting the fluorescence; f) identifying the single nucleotide by its fluorescence; and g) repeating steps a) to f) indefinitely (e.g., until the DNA strand is fully cleaved or until a desired length of the DNA is sequenced). The apparatus of the invention includes a cleaving station for the extraction of DNA from cells and the separation of single nucleotides from the DNA; a transport system to separate the single nucleotide from the DNA and incorporate the single nucleotide in a fluorescence-enhancing matrix; and a detection station for the irradiation, detection and identification of the single nucleotides. The nucleotides are advantageously detected by irradiating the nucleotides with a laser to stimulate their natural fluorescence, detecting the fluorescence spectrum and matching the detected spectrum with that previously recorded for the four nucleotides in order to identify the specific nucleotide.

L3 ANSWER 34 OF 46 USPATFULL

PI US 5639671 19970617

AB Method for optimizing an optical assay device for an analyte, including the steps of: providing a substrate having a chosen thickness of an optically active layer thereon; providing an attachment layer of a chosen thickness on the optical coating; providing a receptive layer of a chosen thickness for the analyte, wherein at least one of the thicknesses of the optically active layer, attachment layer and receptive layer is varied to provide a plurality of thicknesses of that layer; contacting analyte with the receptive layer under conditions in which an increase in mass on the receptive layer results; and

determining the optical thickness of the layer.

L3 ANSWER 35 OF 46 USPATFULL
PI US 5631171 19970520
AB An instrument configured and arranged to detect a change in thickness or refractive index of a thin film substrate. A method for optimizing the instrument and a method for detecting a change in thickness or refractive index of a thin film substrate.

L3 ANSWER 36 OF 46 USPATFULL
PI US 5629214 19970513
AB A method for forming an optical device for detecting the presence or amount of an analyte of interest comprising a substrate which supports an optically active layer, an attachment layer provided on the optically active layer, and a receptive layer specific the analyte provided on the attachment layer. The method comprises forming the optically active layer with a chosen refractive index on the substrate by curing the optically active layer on the substrate at a controlled temperature or for a controlled length of time and subsequently providing the attachment and receptive layers on the optically active layer.

L3 ANSWER 37 OF 46 USPATFULL
PI US 5587224 19961224
AB A coated donor roll comprised of a core with a coating thereover comprised of a photolysis reaction product of a charge transporting polymer and a photo acid compound.

L3 ANSWER 38 OF 46 USPATFULL
PI US 5552272 19960903
AB Device for detecting the presence or amount of an analyte of interest, comprising a reflective solid, optical support and a label capable of generating fluorescent signal upon excitation with a suitable light source wherein said support comprises an attachment layer comprising a chemical selected from the group consisting of dendrimers, star polymers, molecular self-assembling polymers, polymeric siloxanes, and film forming latexes wherein the support provides an enhanced level of exciting photons to the immobilized fluorescent label compound, and wherein the support also increases the capture of fluorescent signal.

L3 ANSWER 39 OF 46 USPATFULL
PI US 5550063 19960827
AB Method for producing an optical assay device having a substrate and one or more optical layers, an attachment layer and a receptive layer, including the step of spin coating an anti-reflective layer or an attachment layer.

L3 ANSWER 40 OF 46 USPATFULL
PI US 5541057 19960730
AB Method for detecting the presence or amount of an analyte of interest in a sample by providing a substrate having an optically active surface exhibiting a first color in response to light impinging thereon, and exhibiting a second color comprising a combination of wavelengths of light different from the first color or comprising an intensity of at least one wavelength of light different from the first color, in response to the light when the analyte is present on the surface in an amount selected from any one of 0.1 nM, 0.1 ng/ml, 50 fg, 2.times.10.sup.3 organisms comprising the analyte; and contacting the optically active surface with a sample potentially comprising the analyte of interest under conditions in which the analyte can interact with the optically active surface to cause the optically active surface to exhibit the second color when the analyte is present.

L3 ANSWER 41 OF 46 USPATFULL
PI US 5494829 19960227
AB Instrument configured and arranged to detect the presence or amount of an analyte of interest on the substrate of an optical device. The

instrument has a source of linearly polarized, monochromatic light positioned at an angle other than Brewster's angle relative to the substrate; and an analyzer positioned at the same angle relative to the substrate at a location suitable for detecting reflected polarized light from the substrate; wherein the analyzer is configured and arranged to approximately maximize the change in intensity of the light reflected from the substrate that is transmitted through the analyzer when a change in mass occurs at the substrate relative to an unreacted surface.

- L3 ANSWER 42 OF 46 USPATFULL
PI US 5482830 19960109
AB Device for detecting the presence or amount of an analyte of interest, having a substrate possessing an optically active surface which exhibits a first color in response to light impinging thereon, and exhibits a second color comprising a combination of wavelengths of light different from the first color or comprising an intensity of at least one wavelength of light different from the first color, in response to the light when the analyte is present on the surface of any amount selected from 0.1 nM, 0.1 ng/ml, 50 fg, and 2.times.10.³ organisms comprising the analyte.
- L3 ANSWER 43 OF 46 USPATFULL
PI US 5468606 19951121
AB Device for detecting the presence or amount of an analyte of interest, having a substrate possessing an optically active surface which exhibits a first color in response to light impinging thereon, and exhibits a second color comprising a combination of wavelengths of light different from the first color or comprising an intensity of at least one wavelength of light different from the first color, in response to the light when the analyte is present on the surface in any amount selected from 0.1 nM, 0.1 ng/ml, 50 fg, and 2.times.10.³ organisms comprising the analyte.
- L3 ANSWER 44 OF 46 USPATFULL
PI US 5418301 19950523
WO 9317060 19930902
AB The invention relates to a dendritic macromolecule of the polyester type comprising a central initiator molecule or initiator polymer having one or more reactive hydroxyl groups (A). The groups (A) are under formation of an initial tree structure bonded to reactive carboxyl groups (B) of a monomeric chain extender having the two reactive groups (A) and (B). The tree structure is optionally extended and further branched from the initiator molecule or initiator polymer by addition of further molecules of a monomeric chain extender by means of bonding between the reactive groups (A) and (B) thereof and is thereafter optionally further extended by reaction with a chain stopper. The invention also comprises a process for preparation of the dendritic macromolecule.
- L3 ANSWER 45 OF 46 USPATFULL
PI US 5418136 19950523
AB Optical assay device having an active receptive surface supported on a pedestal and held within a first container; the first container comprising first absorbent material located at the base of the pedestal, configured and arranged to absorb liquid draining from the surface, and having a second container, hingedly connected to one side of the first container, the second container comprising a second absorbent material, wherein the second container can be closed to the first container by rotation about the hinge, and wherein such closing causes the second absorbent material to contact the surface.
- L3 ANSWER 46 OF 46 USPATFULL
PI US 5093030 19920303
AB A dispersion containing minute polymer beads possessing a thermosensitive characteristic is produced by a method which comprises preparing an aqueous solution of an acrylamide type vinyl compound, the homopolymer of which exhibits a hydrophilicity-hydrophobicity thermoreversible solubility characteristic, adding a cationic or anionic

surfactant in a ratio equaling or exceeding the micelle concentration to the aqueous solution, adjusting the resultant aqueous solution to a temperature not lower than the clouding point thereof and, at the same time, polymerizing the acrylamide type vinyl compound in the aqueous solution thereby forming a polymer emulsion, exposing the emulsion to an ionizing radiation thereby cross-linking minute polymer beads in the emulsion, and thereafter depriving the resultant polymer emulsion of the surfactant.

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